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Article

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Surgery in cervical disc herniation: anterior cervical discectomy without fusion or with fusion

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Abstract: The study included a group of anterior cervical microdiscectomy without fusion performed at one level (either C5-C6 level or at the C6-C7 level) and a second group of patients with same single-level of anterior cervical discectomy with fusion. The kinematic analysis included the range of motion, anteroposterior translation and disc height assessed for the cervical functional spinal units at the operated level and adjacent levels. At the operated level the range of motion and the translation were minimal in the anterior cervical discectomy without fusion group, both for the C5-C6 and C6-C7 levels, and absent in the cervical discectomy with fusion group. The superior adjacent levels translations were greater in the ACDF group compared with the ACD group. The clinical results of both types of cervical discectomy were comparable. In cervical microdiscectomy without fusion the elastic fibrous intradiscal scar at the operated level allows a small degree of mobility and the adjacent cervical levels are not overstressed. No need for anterior cervical discectomy with fusion to trait a single level cervical disc herniation than in selected cases.

Key words: anterior cervical discectomy without fusion, anterior cervical discectomy with fusion, elastic fibrous intradiscal scar, postoperative intervertebral translation

Introduction

Cervical disc herniation is a common pathology of the cervical spine and the surgical treatment lead to the decompression of compressed neural elements and the stability of the cervical spine, without abnormal movements. Anterior cervical discectomy without fusion (ACD) and anterior cervical discectomy with fusion (ACDF) are common approaches among spine surgeons for most cervical herniated discs. Most spinal surgeons consider that the results of these two types of approaches (ACD and ACDF) are comparable both in terms of the decompression and the cervical stability. We tried to determine the biomechanical differences of anterior cervical discectomy without fusion versus anterior cervical discectomy with fusion in this study.

Material and methods

We present a comparative study of patients undergoing one level anterior cervical discectomy without fusion versus anterior cervical discectomy with fusion. The study included forty patients operated at either C5-C6 level or at the C6-C7 level: a group of anterior cervical microdiscectomy without fusion performed at one level on 20 consecutive patients was matched to a second group of 20 patients with single-level of anterior cervical discectomy with fusion based on level, age and sex.

Inclusion criteria for the ACD and ACDF groups:

- patients included for the ACD and ACDF groups presented with clinical symptoms due to one level herniated cervical disc;

- patients had preoperative complete general and neurological examination,

- all patients had preoperative MRI and plain radiographs of the cervical spine anterio-posterior, lateral neutral, flexion and extension obtained preoperatively.

As exclusion criteria: the patients with clinical or imagistic evidence (MRI, X-rays) of additional diseased cervical spine, history of cervical spinal injury were excluded from the study. Also the patients with cervical instability at the level of disc herniation, which need a possible fusion and fixation, were excluded from the group of ACD patients.

The study selection criteria and outcome measures were identical, with the exception being the surgical technique: anterior cervical microdiscectomy without fusion and anterior cervical discectomy with fusion.

Figure 1 - Preoperative MRI of C5-C6 disc herniation and postoperatively MRI after anterior cervical microdiscectomy without fusion

The biomechanical analysis included the intervertebral angulations, antero-posterior translation and disc height assessed for the cervical functional spinal units at the operated level and adjacent levels.

The measurements of preoperative and postoperative anterior-posterior translation of the operated level and of the superjacent levels were compared between the groups of ACD and ACDF. Thus the translations of C3C4 level and C4C5 level were compared for the C5C6 operated level with the same level translation between the groups of ACD and ACDF. The intervertebral translations were measured in millimeters on the converted digital radiographies using DICOM viewer software. These parameters were studied in the matched patients from both groups using the statistical averages, standard deviations, the paired Student's t-test and p-value for statistical significance.

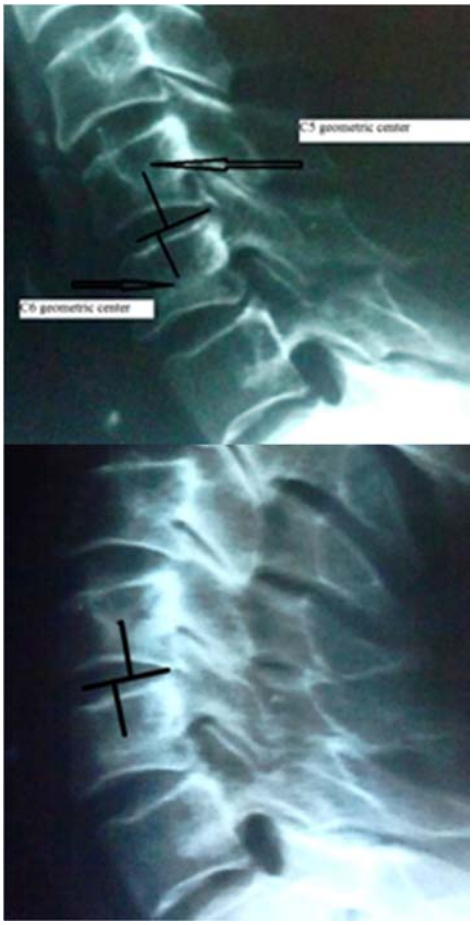

Figure 2 - Intervertebral translation during cervical flexion and axtension

Results

The demographic data of these patients are presented in Table 1. The distribution of patients by age, sex and level of disc herniation is not significant because the cases were selected to match according to the type of surgery.

The clinical results of these two types of approaches were comparable.

At the operated level the range of motion and the translation were present in the ACD group, for operated level, C5-C6 and C6-C7 and were absent in the ACDF group. The statistical averages of the preoperative intervertebral translations of C3-C4 and C4-C5 levels for operated C5-C6 level were equal each level for both type of surgery and also they are very similar for operated C6-C7 level in ACD and ACDF. The statistical analysis using Student's t-test of these postoperative intervertebral translations of superjacent levels of operated level by these two types of surgery found a p-value <0.01, therefore a very good statistical significance as shown in Table 2.

The comparison of superjacent translations for the fusion at C5-C6 and C6-C7 levels found that the inferior level fusion (C6-C7) produced a higher increase in the C3-C4 level translation.

Table I

Demographic data of patients for each group of discectomy (in pairs)

Age	ACD / ACDF C5-C6		ACD / ACDF C6-C7	
	M	F	M	F
35-39	2	1	1	1
40-49	2	1	2	2
50-58	2	2	2	2
Total	6	4	5	5

Table II

The mean values of the postoperatively intervertebral translations during cervical flexion and extension for operated C5-C6 / C6-C7 disc herniation (in mm). (p<0.01)

Operated levels	Measured level	ACD	ACDF	Δ	Normal (mean)
C5-C6	C3 - C4	2.4	2.6	0.27	2.1
	C4 - C5	2.3	2.4	0.10	2.5
	C5 - C6	0.5	0	-	2.2
C6-C7	C3-C4	2.1	2.4	0.34	2.1
	C4-C5	2.2	2.4	0.2	2.5
	C5-C6	1.54	1.67	0.13	2.2
	C6-C7	0.14	0	-	1.3

The range of motion and the translation were greater at superjacent levels in the ACDF group compared with the ACD group.

Discussion

In this study we determined the differences in the intervertebral translations one year postoperatively after anterior cervical microdiscectomy without fusion versus anterior cervical discectomy with fusion in two groups in pairs, each of 20 patients.

The comparison of our results with the normal data showed the translation was present in the ACD group and the translation was absent in the ACDF group at the operated level. The absence of intervertebral translation at the operated level is explained by intervertebral fusion in the ACDF group. The presence of lower values of intervertebral translation at the operated level in the ACD group is normal and is not a spinal instability. The healing at the operated level after the ACD consists of an intradiscal fibrous scar and not a real bone fusion because the cartilaginous endplates should be left intact. This elastic fibrous intradiscal scar ensures the cervical stability and allows a small degree of mobility at the operated level in the ACD group.

In the ACD group the means of the intervertebral translation were close to normal values at superjacent levels and in the ACDF group the intervertebral translation was greater compared with the normal values and with the ACD group. The comparison of superjacent translations found that the C6-C7 level fusion produced a higher increase in the C3-C4 level translation than the C5-C6 level fusion, therefore the range of motion is higher at a more distant level where the amplitude of movement may be higher.

These results may explain why ACDF may lead to acceleration of degenerative changes at immediately overstressed superjacent discal levels secondary to abnormal spinal motion.

The results of this study and the review of the literature show that ACD has comparable clinical results with ACDF in single level cervical disc herniation and ACD ensures postoperatively a very good cervical stability.

Conclusions

The clinical results of anterior cervical microdiscectomy without fusion and anterior cervical discectomy with fusion were comparable. In anterior cervical microdiscectomy without fusion the elastic fibrous intradiscal scar at the operated level allows a small degree of mobility and the adjacent cervical levels are not overstressed. Anterior cervical discectomy with fusion may lead to acceleration of degenerative changes at immediately overstressed adjacent discal levels secondary to greater intervertebral translation at these adjacent levels.

We believe that there is no need for anterior cervical discectomy with fusion to trait a single level cervical disc herniation than in selected cases with preoperative instability at same level. Anterior cervical microdiscectomy without fusion is a valid option in patients with one level cervical disc herniation without local instability.

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